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East Europe Report

SCIENTIFIC AFFAIRS

No. 766

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EAST EUROPE REPORT

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CONTENTS

 [III - EE - 65]

U.S. SANCTIONS AGAINST POLISH SCIENCE SCORED

Warsaw RZECZPOSPOLITA in Polish 10 Dec 82 p 5

[Article: "American Sanctions: An Anti-Learning Policy"]

[Text] Already during the first half of December 1981 the U.S. administration started to curtail scientific-technical cooperation. With the passage of time the consequences of this policy have become all the more severe. Sweeping directives have been coming out that are mandatory for the entire administration and for independent scientific and technical institutions. thus, a high priority has been assigned to the battle-cry calling for the curtailment of advanced technology transfers to Poland, both in terms of ideas and also of material goods. This has made it possible for the U.S. government to close the doors of certain institutes and universities to Polish scholars.

The process of implementing these restrictions has been backed up by the installation of a shutoff valve which only allows for strictly controlled exchanges. To be sure, all Federal agencies and departments, which normally are not subject to controls in their relations with Poland still retain the right to . . . break off all contacts! However, any useful and constructive course of action should be subject to the censure of dissenting opinions, even when it comes to decisions made by the U.S. State Department. But, as everyone knows anyway, the State Department is really under the jurisdiction of the National Security Council.

We rub our eyes in amazement. How is it that our scholars and their work are subject to controls that are so centralized? The answer to this question can be stated briefly. Namely, as far as the administration of President Reagan is concerned, scientific cooperation can represent something of value only to the extent that it fulfills certain political objectives with respect to Poland and, in a broader sense, with respect to the overall confrontation with our sociopolitical system.

The American side unilaterally made a number of decisions which imposed restrictions both on the scope and on the methods of scientific-technical cooperation with Poland. Let's recall what happened in December 1981: the extension of the agreement on the Marie Curie-Sklodowska Fund, which over the 7 years of its existence had so far allowed for the fulfillment of 247

programs, was dropped. This happened at a time when Polish institutions working on the coordination of cooperation with the U.S. had already sent several dozen new proposals to overseas institutions, and agencies of the U.S. government had already approved more than 40 of our program proposals. In spite of the willingness of the Polish side to do so, the Ninth Session of the Polish-American Fund Supervisory Board was never held. The victims of this action were medicine, agronomy, mining and nuclear physics, environmental protection, meteorology, standardization, geological research, and a whole host of other disciplines in which knowledge needs to be constantly broadened and updated.

In 1982 the meeting of the Joint Committee for Cooperation in Health Care Services was canceled.

A series of seminars scheduled for 1982 on the subject of business enterprise management were held up. Almost all contacts involving scientific cooperation with Poland pursued by organizations under the jurisdiction of specialized agencies (responsible for energy, transportation, environmental protection, and so on) were suspended. Restrictions were imposed on cooperation with the Polish Academy of Sciences, programs which were independently, but in practice indirectly funded out of the budget of the federal National Academy of Sciences. Nor was there anything coincidental about the attempt on the part of the American Association of Mathematicians to stage a boycott against the International Congress of Mathematicians, which was supposed to be held in Warsaw. Falling into the same category is the campaign, launched by institutions which finance the American Pugwash committee, calling for a boycott of the conference scheduled to be held in Warsaw in August 1982. It should be pointed out that American scholars and scientists have been coming to Poland to attend some of these affairs anyway. But they have had to do so at their own expense.

These sanctions have been a blow to the Polish scientific and technical community. During 1982, the ban on exports from the U.S.--and certain other countries--have had an impact, for example, on our industries producing goods under license destined for export to capitalist countries. Some specialists estimate that a falloff of 10 or more percentage points in the output of these goods is going to cost us somewhere in the vicinity of 500 million dollars. If you add to this the cutoff of deliveries of coproduction goods and spare parts, our industries would wind up being able to turn out only a small percentage of the goods they are supposed to be producing under license. This is especially true in the case of industries manufacturing radio equipment, sewing machines, automobiles, and so on. It goes without saying that this is going to affect the level of supplies in our own domestic marketplace in a major way.

The scope and effectiveness of the instruments brought to bear for this purpose by the U.S. administration is significant. We are by no means going to foster any hopes to the effect that it will be inconsistent in the enforcement of these sanctions. No decisions have been made there to cut off totally all contacts with the Polish intellectual elite. Perhaps this is because it feels that, in spite of everything, there is still something

or other to be learned from our intelligentsia, while, on the other hand, it does not want to completely alienate the American academic community. This is a community which, as the evidence shows, is full of misgivings about the attempts of the government to interfere in too brutal a fashion in the realm academic affairs. Americans have become especially sensitive on this score, especially so since the days of McCarthyism.

Polish academia has already learned many things from this experience. It also holds true in the realm of scientific-technical cooperation that not even the possible total lifting of these sanctions is going to restore things to the way they used to be. The lessons learned from this experience are going to continue to have an impact in other areas. Such brutal lessons cannot be quickly forgotten.

11813
CSO: 2602/7

INTEGRATED-CIRCUIT MARKINGS, ROBOT PRODUCTION OUTLINED

Soviet-International Markings

Warsaw POMIARY AUTOMATYKA KONTROLA in Polish No 5-6, May-Jun 82 pp 189, 190

[Article: "Markings on Integrated Circuits Manufactured in the USSR"]

[Text] Integrated circuit markings are based on GOST standard 18682-73 and 17021-75 and consist primarily of the following four elements:

First element--a single-digit symbol referring to the manufacturing technology: semiconductor circuits--1, 5, or 7 (7--hybrid circuits manufactured without housings--2, 4, 6, and 8); all other technologies--3.

Second element--a two- or three-digit symbol which represents the ordinal number assigned to the circuit design within a given technology class.

Third element--consisting of letters denoting the function of a given circuit and the subcategory of a given function in accordance with the following key:

(1) Generatory (Г)	
1a sygnałów harmonicznych	ГС
1b sygnałów prostokątnych	ГГ
1c sygnałów zmiennych liniowo	ГЛ
1d sygnałów specjalnego kształtu	ГФ
1e sygnałów szumu	ГМ
1f innych sygnałów	ГП
(2) Komutatory i klucze (К)	
2a prądowe	КТ
2b napięciowe	КН
2c inne	КП
(3) Układy wielofunkcyjne (Х)	
3a analogowe	ХА
3b cyfrowe	ХЛ
3c mieszane	ХК
3d inne	ХП

(4) Modulatory (М)	
4a amplitudy	МА
4b częstotliwości	МС
4c fazy	МФ
4d impulsów	МИ
4e inne	МП
(5) Wtórne źródła zasilania (Е)	
5a prostowniki	ЕВ
5b przetworniki	ЕМ
5c stabilizatory napięcia	ЕН
5d stabilizatory prądu	ЕТ
5e inne	ЕП
(6) Detektory (Д)	
6a amplitudy	ДА
6b impulsów	ДИ
6c częstotliwości	ДС
6d fazy	ДФ
6e inne	ДП

[Chart continued on following page]

(7) Elementy logiczne (Л)

7a	NAND	ЛА
7b	NOR	ЛЕ
7c	AND	ЛИ
7d	OR	ЛЛ
7e	NO	ЛН
7f	AND-OR	ЛС
7g	NAND/NOR	ЛБ
7h	AND-NOR	ЛР
7i	AND-NOR/AND-OR	ЛК
7j	NOR/OR	ЛМ
7k	rozszerzacze	ЛД
7l	inne	ЛП

(8) Zestawy elementów (Н)

8a	diod	НД
8b	tranzystorów	НТ
8c	rezystorów	НР
8d	kondensatorów	НЕ
8e	kombinowane	НК
8f	inne	НП

(9) Układy opóźniające (Б)

9a	bierne	БМ
9b	czynne	БР
9c	inne	БП

(10) Przetworniki (П)

10a	częstotliwości	ПС
10b	fazy	ПФ
10c	czasowe	ПД
10d	napięcia	ПН
10e	mocy	ПМ
10f	poziomu (dostrajające)	ПУ
10g	kod — analog	ПА
10h	analog — kod	ПВ
10i	kod — kod	ПР
10j	inne	ПП

(11) Układy wybierające i porównujące (С)

11a	amplitudowe (poziomu)	СА
11b	czasowe	СВ
11c	częstotliwościowe	СС
11d	fazowe	СФ
11e	inne	СП

(12) Układy formujące (А)

12a	impulsów prostokątnych	АГ
12b	impulsów specjalnego kształtu	АФ
12c	prądów adresowych	АА
12d	prądów wyładowania	АР
12e	inne	АП

(13) Elementy układów pamięciowych (Р)

13a	macierze pamięci:	
13b	operacyjna (wewnętrzna)	РМ
13c	stała (ROM)	РВ
13d	operacyjna ze sterowaniem	РУ
13e	ROM ze sterowaniem	РЕ
13f	ROM ze sterowaniem i jednorazowym programowaniem	РТ
13g	ROM ze sterowaniem i wielokrotnym programowaniem	РР
13h	analogowa	РА
13i	inne	РП

(14) Przerzutniki (Т)

14a	typu JK	ТВ
14b	typu RS	ТР
14c	typu D	ТМ
14d	typu T	ТТ
14e	dynamiczne	ТД
14f	*Schmitta*	ТЛ
14g	kombinowane (DT, RST i inne)	ТК
14h	inne	ТП

(15) Wzmacniacze (У)

15a	wysokiej częstotliwości	УВ
15b	pośredniej częstotliwości	УР
15c	małej częstotliwości	УН
15d	sygnałów impulsowych	УИ
15e	wtórniki	УЕ
15f	odczytu i odtworzenia	УЛ
15g	wskazania	УМ
15h	prądu stałego	УТ
15i	operacyjne i różnicowe	УД
15j	inne	УП

(16) Filtry (Ф)

16a	wysokich częstotliwości	ФВ
16b	niskich częstotliwości	ФН
16c	pasmowe	ФЕ
16d	reżektorowe	ФР
16e	inne	ФП

(17) Elementy układów arytmetycznych i dyskretnych (И)

17a	rejestry	ИР
17b	sumatory	ИМ
17c	półsumatory	ИЛ
17d	liczniki	ИЕ
17e	szyfratory	ИВ
17f	deszyfratory	ИД
17g	kombinowane	ИК
17h	inne	ИП

Key: 1. Generators ( )
- 1a. harmonic signals
- 1b. rectangular signals
- 1c. variable linear signals
- 1d. special configuration signals
- 1e. noise signals
- 1f. miscellaneous signals

[Key continued on following page]

2. Commutators and Keys ( )
   2a. current
   2b. voltage
   2c. miscellaneous
3. Multifunction Circuits ( )
   3a. analog
   3b. digital
   3c. mixed
   3d. miscellaneous
4. Modulators ( )
   4a. amplitude
   4b. frequency
   4c. phase
   4d. pulse
   4e. miscellaneous
5. Secondary Power Sources ( )
   5a. rectifiers
   5b. converters
   5c. voltage regulators
   5d. current regulators
   5e. miscellaneous
6. Detectors ( )
   6a. amplitude
   6b. pulse
   6c. frequency
   6d. phase
   6e. miscellaneous
7. Logic Elements ( )
   7a. NAND
   7b. NOR
   7c. AND
   7d. OR
   7e. NO
   7f. AND-OR
   7g. NAND/NOR
   7h. AND-NOR
   7i. AND-NOR/AND-OR
   7j. NOR/OR
   7k. expanders
   7l. miscellaneous
8. Element Networks ( )
   8a. diodes
   8b. transistors
   8c. resistors
   8d. capacitors
   8e. combined
   8f. miscellaneous
9. Time-delay Circuits ( )
   9a. passive
   9b. active
   9c. miscellaneous
10. Converters ( )
   10a. frequency
   10b. phase
   10c. timing
   10d. voltage
   10e. power
   10f. tuning level
   10g. code--analog
   10h. analog--code
   10i. code--code
   10j. miscellaneous
11. Scanners and Comparators ( )
   11a. amplitude (level)
   11b. timing
   11c. frequency
   11d. phase
   11e. miscellaneous
12. Corrective Networks ( )
   12a. rectangular pulse
   12b. special configuration pulse
   12c. address current
   12d. discharge current
   12e. miscellaneous
13. Memory Elements ( )
   13a. memory matrices:
   13b. working (internal)
   13c. static (ROM)
   13d. control and working
   13e. CROM
   13f. CROM with nonreusable programming
   13g. CROM with reusable programming
   13h. analog
   13i. miscellaneous
14. Flip-flops ( )
   14a. JK type
   14b. RS type
   14c. D type
   14d. T type
   14e. dynamic
   14f. Schmitt
   14g. combined (DT, RST and others)
   14h. miscellaneous
15. Amplifiers ( )
   15a. high frequency
   15b. intermediate frequency
   15c. low frequency
   15d. pulse signal

[Key continued on following page]

15e. loaded amplifiers
15f. readout and reproduction
15g. indicator
15h. direct current
15i. operational and differential
15j. miscellaneous

16. Filters ( )
    16a. high frequency
    16b. low frequency
    16c. band-stop
    16d. rejector
    16e. miscellaneous
17. Arithmetic and Discrete Circuit Elements ( )
    17a. registers
    17b. adders
    17c. half-adders
    17d. counters
    17e. coders
    17f. decoders
    17g. combined
    17h. miscellaneous

Fourth element--a single- or multiple-digit symbol denoting the ordinal number assigned to a circuit design within a given design series.

Here is an example of a typical marking assigned to an operational amplifier: 1 40UD11, where 1 signifies semiconductor technology, 40--the fortieth design in a given series, U--amplifier, D--operational, and 11--the eleventh design in this amplifier circuit series.

Additional letter markings are used in front of appropriate symbols:

K--for general-purpose circuits,

KM--also for general-purpose circuits, but only those manufactured in ceramic housings, e.g., KM 155LSC2.

Soviet-International Robot Ratio

Warsaw RZECZPOSPOLITA in Polish 7 Dec 82 p 4

[Article: "Robots in the USSR"]

[Text] By 1990, according to current estimates, industrial robots are supposed to take the place of approximately 250,000 Soviet workers, especially those employed in welding and assembly jobs and also in jobs involving the performance of routine, monotonous functions, something which, as scientists have observed, leads to rapid fatigue. Approximately 6,000 robots, or more than 20 percent of the total installed throughout the world, are already in service in the USSR.

The first industrial robots came onto the scene in the USSR in 1972. It took around 7 years before the first prototypes went into mass production. The Design Office of Leningrad Polytechnic University is regarded as a leading research and development institution in this field.

Soviet industry is now engaged in the mass production of approximately 50 models of so-called first-generation industrial robots. These robots are subdivided into two basic categories, i.e., pneumatic robots with a lift capacity of 10 kilograms and hydraulic robots capable of lifting heavy loads.

It is generally believed that demand for these machines in the Soviet economy in 1985 will exceed 125,000 units, but the volume of output in 1985 is not supposed to go any higher than 40,000 units per annum.

Soviet designers plan to base the entire production program on from 20 to 25 basic models and around 10 basic control systems.

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ACADEMICIANS DISCUSS CSSR SCIENCE

Prague TVORBA in Czech No 45 10 Nov 82 pp 3-5

/Discussion with officials of the Czechoslovak Academy of Sciences by TVORBA and NOVE SLOVO: "Paths of Our Science," with Academician Rohumil Kvasil, chairman of the Czechoslovak Academy of Sciences /CSAV/; academicians Josef Riman, Zdenek Snitil, Vladimir Pokorny, and Premysl Rys, vice chairman of the CSAV; Academician Radovan Richta, CSAV Presidium member; Academician Oldrich Benda, Slovak Academy of Sciences Presidium member; interviewers for TVORBA and NOVE SLOVO: Jaroslav Korinek, Stanislav Hanis, Ruzena Wagnerova, Alena Walekova/

/Text/ We conducted this discussion with top officials of our Academy of Sciences only a few days prior to the upcoming 30th anniversary of the founding of the CSAV, 17 November 1982. In this three decades of work no small number of experiences, opinions and suggestions have been accumulated, all of which it will certainly make sense to consider in future years, not only in science, but in our entire society as well. Moreover, without that which has gone before, it is impossible to think about what will and should be in the future. And this is the thought that became the central motivation for our discussion, which we began with a look at the 30-year history of our most important research and development institution.

Kvasil: In 1952, a scientific organization was founded in our country, in the form of the CSAV, that was new to Czechoslovakia. Previously, to be sure, there had also existed various so-called learned societies which were significant in that they cultivated, or attempted to cultivate science, primarily at the college level. They cultivated science, I would say, rather in a literary manner, but never in terms of an active resolution of scientific tasks. And this was the essence of the novelty when, in 1952, on the basis of the traditions of basic research handed down from the colleges, an academy was founded on the Soviet model, i.e., not only as a learned society, a selected group of researchers, but as an institution actively involved in the management of science and in scientific work at its own specific research facilities. New workplaces were created, new research institutes appeared under a single leadership. Scientific forces were

concentrated which had previously been active in a fragmented way, dispersed at individual colleges and other facilities. Understandably, in the initial period after the establishment of the academy there was some tension between our workplaces and the colleges, because a number of superb researchers moved from college faculties to our facilities whether the colleges liked it or not. But these are all matters of history, and we have now reached the stage of the effective, workable integration of academic, collegiate and industrial basic research facilities.

Benda: The 30th anniversary of the founding of the CSAV is a cultural celebration for both of our peoples. The founding of the CSAV paved the way for the creation of the Slovak Academy of Sciences /SAV/, which was founded in July 1953 and which represents, as an organic component of the CSAV, the most senior scientific institutions in Slovakia. On this occasion it is also appropriate to acknowledge the unselfish assistance of Czech researchers who helped to develop many scientific departments in Slovakia and, following the founding of the SAV, provided moral and scientific support for their workplaces. The years of existence of the CSAV and the SAV confirm the correctness of the principle of unity of Czechoslovak science which, in cooperation with all research institutions in our country, makes possible the assurance of the further flowering of Czechoslovak science in close conjunction with the development needs of our society.

Certain specific differences exist in the positions of several CSAV and SAV facilities in the research and development /R & D/ base, especially in the fields of the natural and technical sciences. While CSAV facilities have been able to draw upon a relatively well-developed network of industrial developmental affiliates and applied research facilities, SAV facilities have often fulfilled the responsible function of being the single facility in Slovakia for the development of a particular scientific field. In computer R & D, for instance, the SAV had no industrial partner, leaving the entire burden of technical progress on its shoulders. The positive results achieved in the basic research conducted by the SAV was the stimulus for the founding of an industrial R & D capability and the founding of an entire branch. I could cite more such examples, which confirm the correctness of the wise decision of the party leadership to include the building of basic research facilities in its program for the economic and social development of Slovakia as an essential condition for the harmonious development of the socialist social order in Czechoslovakia. Just as we were witnesses to the industrialization of Slovakia in the fifties and sixties, so in the seventies and eighties will we see a gradual coming into balance in the area of science, to which institutions of the CSAV and SAV will make no small contribution.

Rys: I think that the founding of the CSAV was a manifestation of an objectively existing necessity, namely of institutionalizing science in Czechoslovakia, in an industrially advanced country in the fifties of the 20th century. The development of science in this period was such that it could no longer be cultivated in its existing forms. Science had become professionalized, and in particular its experimental fields had become constantly more complex and demanding, not only in a technical sense but also economically. Experimental equipment is unbelievably expensive and its

operation requires staffs of people. This kind of science cannot be conducted only during the "spare" time of teachers at the college level, but is possible only in professional institutions. It was a matter of Czechoslovakia choosing an appropriate model for the building of this kind of scientific institutions. In accordance with the development of the political situation, our country chose the Soviet model, in which the Academy of Sciences is a professional learned society, outfitted with everything needed by modern science.

Riman: Science may be defined in many ways. As is well known, science is a system of findings concerning objective reality which in this sense belongs neither to the base nor to the superstructure. Only the question of who is served differentiates science. The theoretical foundation for science in the socialist countries was provided by Marx, who demonstrated its function, i.e., science as a force of production, which is the current center of attention. In these terms, science is the control lever of the civilizing process. By the same token, we must be aware that by virtue of its discovering function science is also an integral component of the values of the human race, and as an integral component of this system it undoubtedly belongs in the realm of culture, sharing actively in its formation. Academician Benda has stated here that the anniversary of the academy is a celebration for both our peoples. Here one sees the dual social function of science and in this regard I would like to recall Gottwald's leadership of the party, which established science in this country in a major way, so that it could fulfill in a Marxist manner all of its functions. I am of the opinion that we must view in this light both the mission of science and its practical contributions. One often hears the slogan "a science of practice," but I think that it would be improper, as well as nondialectical, to stop here, because just as science is to serve practice, so must practice serve science, a fact that we forget all too often. We even forget about it when determining the conditions for this second reciprocal tie. Why? This reciprocal link is itself evident throughout the history of science. Pasteur received the practical assignment in Lyon of studying the problem of poorly fermented beer, during which he discovered laws which formed the foundation for the development of modern microbiology. This reciprocal link is again evident in the seventies of our century when out of research undertaken as science for science's sake there has opened the era of genetic engineering and genetic manipulation generally which is significantly stimulating the development of biotechnology.

Richta: Basic research is that part of science whose results are mostly hidden from the public. Few people are aware of actually what this research has contributed. It operates over long cycles, and by the time progress is made from the scientific discovery to an actual change in human life that is generally perceptible, much time may elapse. Few are able to imagine, including the scientists themselves, what a given discovery might mean for the future, for the forms and types of human life. And many things which are eventually applied in practice then become commonplaces very quickly, seen by people as things with which they have long been familiar. Marx noted that it may take science a long time to make a discovery, but that each such discovery quickly becomes a completely normal item; all at once it appears obvious, and everyone marvels that people were able to live at all without knowing it.

I recall a conversation from the period of the founding of the academy with professors Hrozny, Studnicka and others concerning the development and fate of our science. They reminded us that in the past we have had a number of outstanding scientists, both in the Czech lands and in Slovakia, that we are not short of outstanding talent as a people. These people also noted, however, that scientific work in basic research was previously only a sideline for many of these outstanding talents, something to which they could devote themselves only outside of their actual work, which meant that little time was left for it, both in the laboratory and in colleges. We have not had the tradition once advocated by Purkyne: "build yourselves strong institutes, important working scientific facilities." It has been the lot of our scientists for the most part to work on peripheral and small scale projects rather than on large and central objectives. This is why the establishment of the CSAV is of such revolutionary historical significance for us--much more profound than we are perhaps aware. It represents not only the founding of an institution, but also a profound change in our cultural tradition and the life of society. And it is no accident that it was connected with a socialist revolution.

/Question/ The founding of the CSAV and, 1 year later, of the SAV created new possibilities for the development of science. We were interested in what exactly our academy had achieved over this 30 year period--and the answer? We learned for instance about a world renowned polarographic school, about mathematical topology, about quadrupoles, about bubbles, about monocrystalline germanium and silicon, about chemosine, virology, monoclonal antibodies, peptides, restrictages, cancer viruses, monensine, the microbiological evaluation of sulphite waste liquors, a geobotanical map, about new conceptions of research into our history and our current reality, in short, we heard and noted down so much that we will be able to share it all with our readers only at some other time. Even a thumbnail outline of the noteworthy results of research by our academy would necessitate changing probably all the remaining lines of our paper into an index composed of, for the most part, unusually obscure concepts. At the same time, this is a matter of successes known throughout the scientific world as well as of results which are in no way distinctive scientifically but which have meant, during the academy era, national economic savings measured in the hundreds of millions and billions of korunas. In addition to this, we were aware that despite the reality of the approaching anniversary, we had gathered here mainly in the interest of the future, so as to learn the intended focus of the academy and of all Czechoslovak basic research, why these directions have been chosen and how they will be pursued. We therefore moved to the next question.

The Academy was given the mission of watching over the direction and coordination of all of our basic research. This implies a simple and straightforward question: Is basic research in the CSSR administered well? And if not, where do the major problems lie?

Kvasil: That is, by the way, a burning question. The current system of state plan administration was instituted about 15 years ago. Its advantage is that within its framework basic research is administered uniformly. The academy coordinates it, even though colleges and industrial workplaces

participate in it. We of course do not plan the outcomes, this is not even possible, but rather the main directions of basic research. Another issue, however, is the extent to which we hit the mark in terms of what is optimal given the potential of our science and the needs of our society. To be frank, we encounter a lot of subjectivism. Certain objectives persist in being accorded more priority than is necessary. We would prefer not to include others in the plan at all. Therefore, even though we are trying to eliminate these shortcomings during the Seventh 5-Year Plan, I can tell you that we still have a lot to do in this area. I see an improvement in the planning and administration of basic research in a more scientific means of preparation for the formulation of the best research objectives.

What do I mean by a more scientific manner? Simply that we obtain in a more scientific manner the foundations for administering research, both in a programmatic and a day-to-day sense. Proceeding in the current manner, we have lacked a lot of input information. We must have an overview of the long-term development of the national economy. We need to know the prospects for the development of specific scientific fields so that we can make judgments concerning what we are capable of achieving and what can be incorporated into the plan and also from the viewpoint of our national economic development. In other words, we are preparing ourselves for prognosticative activity to a greater extent both within the academy and outside it, and from a broader economicosocial viewpoint as well, so that we can approach plan formulation more scientifically. This is what I consider to be the major task for the future.

A second issue is the relationship between basic research administration and the overall administration of scientific and technical development and external relationships, i.e., in areas that the academy cannot handle by itself. I do not know if it is possible to put matters this plainly, because there were various opinions on the optimal way of administering scientific and technical development. For most of the employees of the academy the optimal method of administration is the Soviet one. When Academician Marcuk, chairman of the USSR State Committee for Science and Technology, was here in the spring he informed us of the way in which overall scientific and technical development is managed in the Soviet Union. I do not want to make a prediction, but it is quite possible that we have much to learn from this for our own practice. So as to summarize; we are not completely satisfied with the current manner of forming the plan for scientific and technical development. It is our opinion that the management system for basic research, for plan implementation and application, is obsolete and that it is necessary to administer certain priority tasks by directive, and not simply administratively, as the vast majority of the state plan still is today.

Rys: I will attempt to point out another aspect of the same problem. As one recalls the 30 years of multifaceted activity of the academy, it is possible to cite numerous examples of the application of scientific findings. Almost from the beginning, the Commission for Major Construction Projects for Socialism worked within the academy, and now there is the Commission for Water Management under the CSAV Presidium. This commission, for instance, played an important role in conceptualization and construction of the Moldau cascades. This is an exceptionally significant water management and energy project and the academy can be proud that it participated in it.

A second example is from the Brno Institute of Equipment Technology, whose employees have developed a number of electronic instruments. One of its electron microscopes, the so-called small or table electron microscope belonged, in terms of the number of units produced, among the most successful in the world. Its production in the Brno Tesla factory has contributed significantly to the rise of an exporting tradition at this factory.

Both examples point to the variety of possible participation modes for the academy in national economic development. It is proper to be aware that the current structure is a reflection of 30 years spent building the academy and is influenced by the importance and position of the men of science who were present at the birth of its institutes. The structure of the CSAV, therefore, cannot be a precise reflection of the current needs of our national economy and society. The existing conflict between practical requirements and scientific possibilities become evident in discussions with representatives of the mplementational sphere. The conception of science as an almost omnipotent force must be correlated with the actual constraints such as facilities, experimental equipment, the personnel structure and, last but not least, the structure of the academy and its institutes. The minimizing of this conflict is the task of the management of science. In short-term plans, this is accomplished through the state plan for basic research which must manage the existing research facilities in the interest of the resolution of the most essential public tasks. A change in the structure of the academy is a long-term process and the systematic improvement of the scientific base is unthinkable without ongoing long-range planning.

Kvasil: I have stated that there are subjective influences of various shortcomings in both the management of science and in its structure. There are also objective influences. In what sense? In the fifties and sixties we in the CSAV, and this was true of all academies of science in the socialist countries, with the possible exception of the GDR, rid ourselves of applied research and purged from the academy everything that smelled of application, trying to cultivate only the so-called pure sciences. At that time this meant, for instance, in the field of science concerning inorganic nature, the fields of physics, mathematics and chemistry partially. And what at that time was founded in the area of applications, even if modestly, such as an optics laboratory or other facility, as far as I can recall was shunted away from the academy to industry. Today we would gladly take this all back.

At that time, we were in contact with the Ministry of Heavy Engineering. The fact of the matter is that there is no equivalent institute at the academy for the development of the engineering industry, and I do not have in mind here the electrotechnical industry. There are institutes which concern themselves with various theoretical aspects of the engineering industry. There is the Institute for Physical Metallurgy, the Institute of Theoretical and Applied Mechanics, the Institute of Thermomechanics, but we do not have an institute directly "dedicated" to the specific needs of the industry. Only now have we gotten around, within the framework of the building of regional centers, to the gradual establishment of such an institute in Plzen, affiliated with the Skoda Works. There are objective reasons for this as well, related to historical developments, and over which employees of the academy

have had no control. These are related to the implementation base, which I continually refer to indirectly, because it is weak. I do not mean that we need to produce something. I am thinking of the implementation of those extensive experiments which are becoming more and more demanding. We do not have anything of this kind. In comparison with the GDR, where there are 3,000 employees in this area, we have 140, not including the mechanics at specific institutes. This is also a problem of internal structure. If there are relatively more scientific employees in relation to other employees, then the findings are only on paper, because there can be no implementation, there are no technicians, equipment, etc. This situation must be rectified.

Riman: Yet another matter connected with administration. In recent years a new factor has come to the fore--intradisciplinary and multidisciplinary approaches. This implies our responsibility to conduct scientific planning according to problem groups, which will as a rule require the participation of more than one scientific discipline in their solution. I can cite a concrete example--the program of the state plan for basic research entitled "Structure and Function of Organic Materials," which was founded by Academician Blaskovic in 1971. From the beginning it has been conceived of theoretically and today, after 10 years it may be said that we have reached precisely those areas which represent contemporary trends in basic molecular biological research. But there is another question here. At present the line between pure and applied research has been quite blurred. This serves to call more attention to the boundary between bad science and good science.

The flow of information between basic and applied research is not unidirectional. This is a reality that did not exist at the time when the academy was founded. Industry for science. And if our society provides a supportive environment for industry for science, let us say in the area of atomic energy generation, then we must admit that it does not do so in the strategic area of the development of biological sciences. It is not a matter of scientific work being made easier by industry for science, in the sense that a rapid implementation of basic research findings leads to the development of science itself, but that industry remains commercially viable through science and in turn stimulates science. This is an area of difficulty, an umbilical cord by which we are far too dependent on the capitalist countries.

Therefore, in the priority plan of the academy we are attempting to overcome in stages the existing barriers. We are attempting to accomplish this, on the one hand, by building a specialized service capability within the academy, and, on the other hand, by setting up affiliations with other specialized facilities in the socialist countries, primarily in the USSR and GDR. In the biological sciences, this kind of complementarity exists in molecular biology between the academies of science of the USSR and GDR and our academy. We are trying, nevertheless, to incorporate certain specialized products into our own industry, because basic research does not exist in order to be one step behind someone else permanently. It is a matter of our industry committing itself, looking at things with new perspective. Most importznt, I would say, is to designate the main elements of our activity. But this is not as simple as it sounds.

Our Academy, clearly, has fewer per capita resources, and this can be proven, than the rest of our R & D base, which consists of about 160,000 employees. Even in view of this situation, I am convinced that the task of perceptibly increasing the quality of its scientific and other work is equally valid for our academy. This would help in many areas. We still have many unexplored areas. And it is the choice of priorities that is difficult to implement and assert consistently in this country. This is probably the reason that we currently have 19 target projects in basic research. It is my view that if we had half this amount it would be better in terms of the final results. There were originally 12 such projects and their number subsequently increased to 19. They are all very important questions which can be answered and whose answers are currently being pursued actively by the academy. However, we must never forget in the course of our basic research that a discovery is difficult to plan for or predict. If, however, some kind of crucial finding does appear, it is necessary rapidly to discern the nature of the discovery and to set out on the scientific direction opened by this finding. We also cannot lose sight of the fact that, over time, any given construct may change radically, and that we must be able to react properly with a precise alteration of the plan and work techniques, including working style.

/Question/ And you are convinced that that which is being given to Czechoslovak science is being responsibly utilized?

Riman: I am convinced that the results which the CSAV is able to show (and 2 years ago material was assembled documenting about 100 cases of unutilized findings of basic research) demonstrate that our basic research can make a positive contribution to the development of our society given the improved practical application of its findings.

Kvasil: I would rephrase the question. The capacity, that is, the potential of science at the academy is such that if it were supported by certain resources, investments and employees the results would be incomparably greater. Our basic research has great potential. I am convinced that every investment in science pays back society many times over.

/Question/ This leads directly to the question of how we are doing in terms of the effectiveness of science?

Snitil: An answer to the question of whether our science is effective may be answered only one way; it could be much more effective. This is undoubtable. Then the question becomes: What are the preconditions necessary so that our scientific work can be more effective? Recently several steps have been taken which pinpoint the existence of the major areas of underutilized capacity and indicate the path to greater effectiveness of research and development work. In this country, as well as in the USSR and the rest of the world, a shift to intensive development is taking place. This is also true of science. The intensification of scientific work is today the main source of the development of science. What does this presuppose? Above all to generate a clearer picture of the objectives we wish to achieve, to raise the quality of the resources we have to achieve them, and to incorporate greater rigorousness into R & D work at all workplaces.

We began here with predictions concerning scientific and technical development and the related socioeconomic development, not because these are interesting topics, but because predictions are the basis for generating a strategy for mastering the scientific and technical revolution. And this is the fundamental precondition for intensifying the development of science, production and the entire life of society. A Marxist analysis of our contemporary reality indicates that the formulation of a strategy for the development of science is a basic component of a formulated strategy for the development of an entire socialist society. Such a strategy is far from formed only from the findings of science; the latter may contribute only certain fundamentals. What is critical are the requirements for the construction and development of our entire socialist society as formulated by the senior party and state organs of our country. And I would add that in many senses the framework should be broader still, including the politics of the entire socialist society.

We are, therefore, attempting to create the appropriate links connecting science with life--a system of social orders; so that we can know what society wants, so that we can monitor basic public goals and not permit science to proceed haphazardly, governed solely by what someone can force through here or there. In the formulation of this strategy, a decision will also be made as to whether scientific and technical progress will become the focus of all of the planned development of the national economy.

This is related to another question which I have already mentioned. We cannot comprehend and resolve this task only as the formulation of a strategy for the development of our science, but as a component of the development of science and division of labor throughout the socialist community; and for us this means above all cooperation with the scientific and technical base of the Soviet Union. Let me cite an example from the social sciences. Today the vast majority of research projects in these fields are directly linked to international projects. In certain areas, 80 percent of the monographs published are international. And this is logical: the study of socialist society cannot be conducted otherwise than with the combined forces of scholars of the socialist countries.

The development which we note currently in the academy when there is talk of predictions, of target projects, is not one consisting of distinct measures; it is a process which has a more profound basis. It is a way of monitoring change associated with the mastery of new stages in the scientific and technical revolution; it is a way of setting in motion a new function for the academy in the life of society; it is a way of forming in our country a historically new form of science. This is, of course, connected with the overcoming of the old fashioned, with greater demands. It is, plainly and simply, a difficult task which also requires a certain amount of patience. But it is essential and vitally important. When, for example, we take an interest in the development of science worldwide, when we study research concerning the relationship between science and society, which is handled differently in different areas, we notice that opinions are beginning to gain influence in Western countries expressing fear of the development of science. This is, of course, in relation to the nuclear threat of imperialism, the increase in ecological difficulties, the dangers inherent in the misuse of biotechnology, the progress of microelectronics and robotization, which in the West are taking work away from people.

In these countries the feeling is growing that science is something dark, dangerous, insidious and inscrutable. The immense importance of the formation of a new type of science in the socialist countries is in part that it meets these problems face to face. Thanks to the socialist order, thanks to the opportunities possessed by the academies of the socialist countries, science in these countries is taking on the character of an intentional process which considers social consequences, peripheral effects and the entire course of innovation arising from them, and how all of these will affect man. Only in this way can science be placed fully at the service of public needs. I think that sometimes we do not fully appreciate all that this means to us, what the work of the academy actually contributes to our lives, and what above all is the impact of the science policy of our CPCZ. If we are speaking of the effectiveness of science then we cannot have in mind only that which brings momentary, immediate economic benefits. We must monitor the efficiency of science from the viewpoint of social goals, the general development of the strength, cultural richness and abilities of the workers. This, in the final analysis, is the decisive result of the creative research process and the starting point and basis for its further development.

Benda: I would like to emphasize the importance of the proper definition of the objectives of the R & D work of the facilities of the academy, as these are integrated into their plans. We are living in a particular developmental stage of our society for which we have not yet constructed, at the requisite level of quality, an R & D base in the CSSR. The accelerated introduction of the results of basic research into social practice often requires academy employees to perform work of a developmental and applicational nature. While this is necessary and desirable, it is a matter of extent. On occasion, academy facilities come under pressure, on the grounds of comprehending the actual needs of society, to orient the majority of their assets to the resolution of applied research tasks. It is paradoxical, but this type of activity by the academy cannot bring the greatest benefits to society. If, for instance, the academy were entrusted with producing a certain product, it would not be of great help to the national economy, nor would it be any kind of a force in the economy; in short, the academy would not cope well with this type of assignment. Its strength lies elsewhere--in the scientific potential of its employees.

It is essential that the researchers of the academy fulfill an irreplaceable role in the development of knowledge and in the creative transfer of the findings of worldwide basic research to our conditions. In the public interest, then, the academy must, in conjunction with colleges, assist in the establishment of a high quality R & D base also capable of absorbing the findings of others, at all levels right down to the production factory and enterprise, thereby creating space for the fulfillment of its primary function. In this way, the effectiveness of its work will also be increased.

/Question/ This is also connected to the training of new, able researchers, which is not an easy task. Today the boundaries between fields are already becoming less distinct. How is our educational system responding, or adapting to this change?

Pokorny: Academician Rys has spoken here about the education of new researchers. The CSAV leadership has formulated the preconditions for the training of researchers throughout the republic. If we are not satisfied with current planning of research as far as its specialty focus and administration is concerned, then we are also not comlletely happy with what is going on in the training of scientific workers.

We are all aware of how science develops. The comrade chairman of the CSAV has said that previously the so-called pure sciences were cultivated, with some of them compartmentalized according to a so-called natural system of knowledge. But this is all a thing of the past now. Today, as is well known, the boundaries between sciences are becoming less distinct. And how does this correspond to the system for educating research employees? The system is, I would guess, about 20 years behind the times. Not much has been done with it for that time. The structure of specialities already does not correspond to contemporary needs and is notably inflexible. A graduate student is, as a rule, educated in a single major field, in addition to which he may choose from a strictly established list usually two subjects from the broader scientific base. Now it is possible to choose two additional fields. We require, however, a much more flexible system. We have progressed to a point where we are applying the experiences of Bulgaria and the Soviet Union. We have already begun to formulate so-called thematic programs in which, without regard for school subjects or specialties, we aggregate the necessary base with which today's adaptable professional must be equipped for a particular field or area. Another task is the revision of the fields of scientific education. We have now, if I am not mistaken, 180 fields which, however, are very unevenly divided and differentiated. Taking physics as an example, as the comrade chairman can attest, there are five specialties including astrophysics and geophysics, while the field of mechanics has a much larger number of subspecialties. A further problem is the uneven distribution of research workers within the scientific base. Of the 180,000 employees, the academy has the largest number of qualified scientists. Colleges have somewhat of a special position, and then there are the industrial sectors, which have almost no one. The leadership of the academy will actively strive to overcome this uneven distribution, because if we do not have sensitive contacts at enterprises and practical institutions we cannot expect that science will penetrate the practical realm rapidly.

Kvasil: Basically, we are pursuing two objectives in education. The first is a quality education and in this connection the academy has done enough in terms of nonindustrial administration. We are also concerned, however, with the deformalization of education. We do not want to generate regulations, but to educate in a quality fashion. There is one great problem here, however, namely that we are ahead of the times in the number of educated scientific workers at the academy and in the colleges. This is the way I would characterize the current situation. On the basis of the scientific and technical revolution, we have taken a global approach to this question at the college level as well and continue to be seriously concerned with it. However, the ground in the production sphere is not yet prepared to handle this number of scientific workers. This is to its detriment, by the way. Here, there is a disproportion and there, we have a surplus and the result is that we are having difficulties in the placement of graduate students.

Riman: Today there are two trends in education, education by specialty and education by field. The biological sciences clearly demonstrate the two directions. One is called molecular biology, which is a quite imprecise Anglo-Saxon term for a modern biology focused on the discovery of the bases of the functional manifestations of living systems. Then there is the more general field of ecology. The quality of education by specialty must be raised primarily at the colleges, because academic workplaces are acquiring more and more of an interdisciplinary character, as a direct consequence of the professional research character of the academy. Insofar as education by field in the area of the biological sciences is concerned, we are beyond the conceptual stage. In the past 5 years, our school of molecular biology, which was organized without any particular costs, has been repeated five times. The school faculty consists of 31 volunteers from among the leading scientific workers in basic research from all sectors: the CSAV, the SAV, the Ministry of Health and Education, and the Federal Ministry of National Defense. It was attended last year by 243 graduate students from all sectors. It is designed for graduate students of six biological specialties, so that they can gain training in an "esperanto" of a problem-solving approach for molecular biology.

We are also trying in our institutes to assure that our graduate students are not educated, figuratively speaking, as experts in left threading and right threading. Our graduate student, when he finishes, often thinks that he will survive until death with the set of techniques which he has learned. For this reason we are modifying the graduate curriculum at institutes according to the concrete requirements of specific institutes, meaning that the graduate student will also experience a number of different departments, especially those that are linked methodologically with the development of his work. There the graduate student can demonstrate the type of work he is suited for, and not suited for, and if appropriate he has the opportunity to receive training at modern facilities in our country and throughout the world. It is my opinion that the area of education is a cardinal one, especially from the viewpoint of a broad R & D base where for every scientific worker there are 27 employees without scientific qualifications, a ratio with which we cannot be satisfied.

/Conclusion/ Readers should not think that our discussion ended right at this point. On the contrary, it continued for a while, and then for yet another moment, inside, between the doors and outside them, in groups and in pairs. We far exceeded the established timeframe and overcame the illusion that we would somehow be successful in touching on all that is of importance in regard to our academy on the evening before its anniversary, at the beginning of the eighties of the 20th century. Science is multifaceted, composed of surfaces and boundaries, of successes and frustrations, of hopes and problems. One thing, however, is certain--our science, represented here by the leadership of its top institution, the leadership of the CSAV, has shown through all its efforts that it wishes to serve the socialist society well and that it is constantly thinking of how to serve it better than in the past.

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ENERGY SAVINGS IN METALLURGY NECESSARY

Prague HUTNICKE LISTY in Czech No 11, Nov 82 pp 761-763

[Article by Eng Z Suchy, deputy minister, [FMHTS] Federal Ministry of Metallurgy and Heavy Machine Building, Prague: "Directions for Reducing Demand on Energy in Metallurgy"]

[Text] More effective utilization of fuel and energy resources constitutes one of the basic obligations in carrying out the production tasks of the Seventh 5-Year Plan. In 1981, the sector of metallurgy and heavy machine building met the tasks of the state goal-oriented 02 program "Improvements in the Consumption and Utilization of Fuels and Energy" when the relative savings amounted to 16,195 TJ [Tetrajoules]. The demand of metallurigcal production on fuels and energy is decreasing, as can be seen from Fig. 1.

Gigajoules per ton

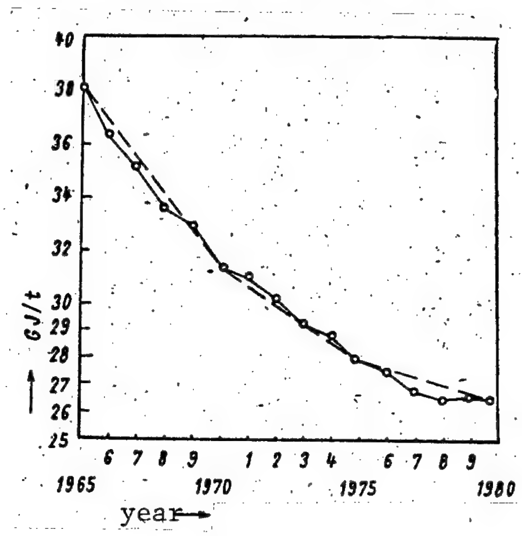

Figure 1.

In spite of the attained results, on a nationwide scale we are the largest consumer of fuels and electric energy, since production and other consumption represents more than 20 percent of the primary fuel and energy resources of the state. The total consumption of fuels and electric energy by the sector in 1981 was on the order of 612,000 TJ which, in recomputation to petroleum, would represent an uninterrupted flow of 27,000 liters per minute.

The distribution of this energy among our key sectors is not balanced, as can be seen from the following outline:

Sector	Solid fuels (1,000 tons)	Liquid fuels (1,000 tons)	Gaseous fuels (mill. cubic m)	Electricity (gigawatthours)
Ore mines	139	168	147	587
Ferrous metallurgy	13,670	1,310	910	7,340
Nonferrous metallurgy	708	90	182	1,800
Heavy engineering	2,543	171	270	1,697

Note: The outline includes consumption of electricity generated by one's own facilities as well as the fuel required for its generation, therefore consumption figures include some duplication.

The focal point of consumption lies in ferrous metallurgy. This branch, in recomputation to standard fuel, consumes annually 478,000 TJ which represents 78 percent of total consumption by the sector and is not a negligible amount even from the nationwide viewpoint. On the basis of what has been said, it can be stated that in contemplating efficient utilization of energy, the producer as well as the consumer must remain aware of the fact that metal per se is an energy carrier and, therefore, good or poor management of metals is tantamount to good or poor management of energy. Particular emphasis must be put on economic management of scrap metals which, from the viewpoint of metal production, is an energy carrier from previous phases of production as opposed to production of new metals from ores.

A high level of recycling of scrap metals results without any doubt in energy savings. Production of steel from scrap metals requires approximately half the energy demand as production from pig iron. For that reason, it is imperative to recycle all scrap metals, even at the cost of using high-grade fuels and electricity.

Production of steel in percent in selected countries depending on the type of production is as follows:

Country	Open-hearth steel	Electr. steel	Tandem. steel	Conv. steel	Scrap steel used in production of steel in kg/t	Share of scrap in kg/t in steel production per 1 percent of open hearth and electr. steel
CSSR	36.9	12.7	27.6	23.4	445	9.2
USA	14.1	24.6	-	61.3	513	13.3
Japan	-	33.6	-	76.4	319	13.5
GDR	9.9	14.0	-	76.1	402	16.9

The preceding table shows that in this respect we still have considerable unused potential. Consumption of scrap metals in a number of countries at a higher

share in production of converter and tandem steel is considerably higher. It amounts up to a share of 16.9 kg/ton per 1 percent of the sum of open hearth and electric steel.

At the present time, consumption of pig iron by tandem furnaces in Czechoslovakia is higher than that by oxygen converters and the greatest unused resources in consumption of scrap metals exist in the case of open-hearth furnaces. It is equally important to systematically follow the current trends of development which point toward increasing the share of scrap metals processed in oxygen convertors. The efforts developed so far in that direction should be stepped up primarily in the East Slovak Ironworks of Kosice which have an adequate capacity of converter steel plants. In the development of the "Oxyvit" process, Vitkovice should also pay attention to increasing the consumption of scrap metals per ton of produced steel.

Continued development and expanded production of electric steel in our country faces certain factors whose sum results in high rated consumption of electricity. Production of electric steel in Czechoslovakia is concentrated in small and obsolescent production facilities and, with a 12.7 percent share of electric furnaces in overall steel production, rated consumption amounts to 685 kWh/t [kilowatt-hours per ton]. The peak on a worldwide scale ranges between 500 and 530 kWh/t. There are several reasons for this state of affairs and key among them I rank the fact that electric furnaces are not produced in the CSSR and, consequently, we are lagging in development of electric furnaces as regards design, control and cooling. In the near future, we cannot count on requisite increases in the production of electric steel from the viewpoint of the nationwide balance of electric energy and a limiting factor for further augmentation of electric furnaces is also the necessity to import electrodes. Due to the effect of the mentioned factors, it will be necessary in the coming years to still continue operating open-hearth furnaces, however under changed conditions, i.e., with a higher share of scrap metals. The share of steel production in open-hearth furnaces will depend on utilization of scrap metals by other steelmaking processes.

Even without increases in steel production, blast furnaces will still constitute the basis of our metallurgical production from which will be derived the demand of other production phases on energy.

Production of pig iron shows at the present time a relatively high occurrence of slag.

Thus, it is imperative to orient our participation in processing of ores toward increasing the share of concentrates and pellets in the overall volume of imported ores.

In addition to solving this key problem, there are a number of technological measures that can positively influence the demand of production on energy in metallurgical operations.

Inadequate capacity of homogenization stockpiles for ores and imbalance in the delivery of individual ores cause considerable fluctuations in the contents of silicon dioxide in the charge and fluctuations in the contents of silicon

in pig iron in a range of 0.5 to 1.1 percent. Reduction of this imbalance calls for basic changes in the manner of initiating stockpiles (tied to supply-and-demand relations), in transportation of raw materials to stockpiles, in technology of homogenization (dependent on the capacity of stockpiles). Under the assumption that we will succeed in reducing these fluctuations in the contents of silicon to a range of 0.6 to 0.9 percent, we shall save 40 to 50 kg of coke per ton of pig iron.

Introduction of bell-less tops of blast furnaces of Czechoslovak production (by the VZKG [Vitkovice Ironworks of Klement Gottwald]) is already proving its positive effects on four blast furnaces. Further reductions in the demand on energy during production of pig iron can also be accomplished by a thorough screening and sizing of the charge ahead of the skip in blast furnaces, which in Vitkovice brought about savings of 15 to 20 kg of coke per ton of pig iron. Identical measures must be implemented at other blast furnaces.

Most enterprises provided services by the VUHZ [Research Institute of Ferrous Metallurgy] in Dobra are making preparations for introducing comprehensive control of blast furnace operation by computers. The greatest success in this direction was achieved by the Vitkovice concern enterprise. One of the key measures in the technological sphere of the steel industry in the Seventh 5-Year Plan is introduction of continuous casting of steel. Another important installation for casting of steel by means of this viable method was launched into operation in May at the East Slovak Ironworks in Kosice. Its operation translates into high material and economic savings. Another installation for continuous casting will be launched into operation this year in the Sverma Ironworks in Podbrezova. Also in preparatory stages is construction of a continuous-casting facility in the Trinec Ironworks. According to foreign sources, an increase in the share of continuous casting by 10 percent of the total volume of cast steel brings about a reduction in initial weight by 20 kg per ton of production.

Utilization of secondary sources of energy and limitation of energy losses to an optimal minimum is one of our prime objectives. In this area, we are still devoting too little attention to utilizing the heat from glowing coke, from liquid slag from blast and steelmaking furnaces, using the heat of ingots and of rolled stock. The technology of dry-quenching of coke is known (USSR license) and should, therefore, be implemented primarily in the case of new coke-oven batteries.

Extensive cooling systems also provide a significant source of heat in metallurgical plants. We successfully solved and implemented evaporative cooling of blast furnaces, but utilization of the heat obtained in this manner still leaves much to be desired. Its full utilization in the plant's energy management is not completely solved and its effect from the energy viewpoint is reflected merely in the form of savings of electric energy which would be consumed in pumping water for forced circulation cooling of blast furnaces.

Considerable unused resources can also be found in utilization of heat from combustion products. In this area, the protracted problem has been unavailability of suitable metal recuperators of domestic production. Extensive innovations will also have to be made in automatic control of operation of heating furnaces of domestic production.

Another equally important area in energy management of metallurigcal plants is electricity, its generation and consumption. Plant-owned power plants of the sector generate up to 30 percent of our consumption and, on the average, under more suitable conditions than that generated by power plants of the Federal Ministry of Fuels and Energy. The rated consumption of fuels for generation of 1 GWh by our power plants in 1981 amounted to 9.41 TJ, while in public utility power plants it was 11.30 TJ. With generation of 3,300 GWh in our plant-owned power plants it translates from the nationwide aspect into a fuel saving in excess of 6,250 TJ which represents 500,000 tons of lignite. The more disheartening is the fact that over the past several years the technological state of plant-owned power plants in metallurgical enterprises has been deteriorating. Installations for generation of heat and electricity are obsolescent and their modernization is progressing very slowly. Increased investments into the area of power plants operated by enterprises will not only increase utilization of secondary energy sources, but will also save for our society the much needed primary fuel sources--simply put, generation of electricity by metallurgical power plants is highly effective from the societal viewpoint and, as such, this area should enjoy the same degree of priority for investments as does the sphere of public utilities.

Reductions in absolute consumption of energy may not be desirable in all areas of our proudction. In the branch of nonferrous metals, their mining, processing and production, it is very difficult to strike the correct balance between the demand of their production on energy and the demand of importation of these raw materials on foreign-exchange resources. For that reason, we must keep taking into consideration not only the demand on energy, but also the task of providing our economy with our own raw materials which more often than not are very expensive.

From what has been said, it can be seen that achievement of additional savings of fuels and electric energy is not only a technical or technological problem, but that it also poses considerable demands on investments. Under the assumption that a special system could be implemented nationwide for expenditure of investment capital allocations into the area of fuel and energy savings, in the framework of our ministry it would be possible to save annually up to 50,000 TJ of energy in comparison to the status quo.

Under the conditions of a socialist state, in addition to a number of technical measures, of irreplaceable significance is the initiative of the working public. Savings of metals and energy are increasingly becoming the object of socialist competition, but also an inexhaustible source of new suggestions and proposals for achievement of savings.

Creation of the prerequisites for their implementation is our primary obligation.

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BRIEFS

NEW FODDER RESEARCH CENTER--Currently under construction in Ivanka near Bratislava is a complex for research of livestock fodder proteins, first of its kind in the CSSR. The 5-hectare complex will incorporate the Research Institute of Fodder Industry and Services (Vyzkumny ustav krmivarskeho priemyslu a sluzieb; currently located in Samorin), the SAV [Slovak Academy of Sciences] Institute of Physiology of Livestock (Ustav fyziologie hospodarskych zvierat SAV) and the Center for Veterinary Sanitation Institutes in Slovakia (Ustredie veterinarnych asanacnych ustavov na Slovensku). The first stage of the construction project should be completed in 1984. The complex will perform comprehensive research in utilization of protein fodder derived from traditional and nontraditional resources. [Bratislava EKONOMIKA POLNOHOSPODARSTVA in Slovak No 12, Dec 82 p 577]

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NATIONAL CONFERENCE ON COMPUTER ASSISTED DESIGN; CONTINUATION OF PROCEEDINGS

Budapest SZAMITASTECHNIKA in Hungarian Sep 82 pp 2, 3

[Article by "s": "First National Automated Technical Design Conference"]

[Text] In the first part of a report on the conference held between 22 and 26 March, in our July-August issue, we gave information on the opening address and on the reports to the electronics and the electrotechnical sections. In the second part we reported on additional sections reports.

Matyas Horvath, a faculty leading university professor at the BME [Budapest Technical University], gave the introductory report for the machine industry AMT [automated technical design, CAD] sections. He outlined the machine industry CAD areas as design of products and tools, manufacturing processes and manufacturing systems. He evaluated especially the outstanding results in technological planning and NC programming, taking into consideration their industrial applications also.

There have been significant achievements in the area of standard systems and system technique, descriptive and intermediate languages, modeling and optimization, geometric modeling, planning principles and decision methods, new solution methods and design dimensioning procedures. A number of circumstances, however, are holding back the spread of them. The most important of these is the shortage of relatively cheap micro and minicomputer CAD configurations. The situation in the area of graphic peripherals is indefensible.

The papers submitted and read at the machine industry sections well reflect and cover practically the entire area of the machine industry and almost all the activities of mechanical engineers.

The papers dealing with questions of machine industry processes, design, technology and production systems embraced the design of hydraulic machines, vehicles, transportation tools and systems, warehouses, machine tools, tools, apparatus and machine elements, the solution of geometric, fluid mechanics and dynamics tasks, the design of traditional and NC technologies, and the modeling and simulation of manufacturing systesm. It was gratifying that they reported the first serious efforts in the area of building and applying integrated design systems. Integration involves bringing into one

system the planning of design and technology on the one hand and technological planning and production control on the other.

A new phenomenon in machine industry CAD is the successful application of logical programming (PROLOG).

The machines being used are extraordinarily heterogeneous. The backwardness in the area of graphic peripherals is palpable and this can be seen especially in the design themes where technical drawings are the results or documentation of design.

The section papers also demonstrated with significant emphasis that there is a shortage of relatively cheap but well designed microcomputer designing stations, which might be manufactured or imported in large numbers in the form of turnkey systems.

Since local applications are characteristic in design planning these sections were dominated by university faculties and research institutes; there were few papers prepared by enterprise experts.

At the same time, for this reason, the industrial experts feel that the possibility of design CAD applications is distant, and this may explain the sparse attendance at the discussion of design themes.

The following might be mentioned among the themes discussed in the summing up session.

Gyula Pikler (MTA [Hungarian Academy of Sciences] SZTAKI [Computer Technology and Automation Research Institute]): Units of a dialog controlled interactive mechanical design system and their application in a CAD axle design system. Imre Lebovits, Janos Barcza, Miklos Babics and Gabor Remzso (BME): Computer aided dynamic analysis of rotors. Maria Kranczler, Gyula Mathasi, Imre Meszaros, Imre Szegh and Bela Weinper (BME): Integrated design and technological planning. Andras Markus and Zsuzsa Markusz (MTA SZTAKI): Instrumentation with logical programming. And Istvan Cser (GTI [Machine Industry Technological Institute]): Computer design of metal cutting technologies.

The sessions of the construction industry CAD sections made it possible to establish broader contact than ever before among institutions dealing with related themes. The traditions for these contacts are good because cooperation and the exchange of information in computer technology work was broad, with the encouragement of the OMFB [National Technical Development Committee], the EVM [Ministry of Construction and Urban Development] and the Ministry of Industry.

The most important trends of the conference, by theme, were as follows:

The spread of construction using the system principle not only opened a new epoch in the creation of apartment houses and industrial buildings but also in technical design and the mechanization thereof, as faithfully reflected

by the conference. A good number of the papers pointed out how computer technology can help planning in this case, selecting from among elements making up the system (beams and columns, wall and roofing elements, etc.) and arranging the buildings.

Experts from the TTI [expansion unknown], PECSITERV [Pecs Planning], GYORITERV [Gyor Planning] and ESZAKTERV [Northern Planning] reported, in connection with a number of construction systems, that developed program systems are serving planning, from the manufacture of elements through strength calculations to the preparation of plan documentation drawings and accounts.

A fixed system facilitates the work of finishing and mechanization of planning, planning, but frequently the result is a soullessly monotonous housing development which public opinion justly takes exception to.

The speakers stressed that this could be mitigated, preserving the essence of the systems, by virtue of a computer technology more effective than the traditional application, although most called for use of new programming methods and technical equipment (conversational mode graphics and cell variant procedures).

The large programs serving system construction are, in any case, of a new type and not rarely lead to scientifically demanding methodological tasks--handling alphanumeric and graphic data bases or algebraic algorithms which offer architects closer access to computer use. Experts from ETI [the Institute of Architecture], the EGSZI [Institute of Construction Management and Organization] and the architecture faculty of the BME called the attention of the conference participants to these things.

According to speakers at the conference sanitary engineering also supplements the building construction branch of construction industry technical planning. The papers dealing with heating systems also merit special mention due to the results leading to energy conservation.

Speakers from UVATERV [Road and Railroad Planning Enterprise], primarily, gave an overview of significant and very diverse CAD work in connection with transportation structures--the professional processing of large volumes of data on traffic, in the interest of developing transportation networks, and graphic representation of it to facilitate evaluation. Computers are used to a large extent to analyse sequential aspects in the design of individual transportation routes, by virtue of a rich collection of programs and the method of automatic data linking. A number of applications pertain to the planning of bridges and tunnels, requiring many calculations.

Engineers from VIZITERV [Water Resources Planning Office], MELYEPTERV [Civil Engineering Designing Enterprise] and the construction engineering faculty of the BME outlined the CAD achievements in public utilities and water engineering, going back many years. They outlined their aspirations for further development, which are aimed at including more and more of the planning process, by making use of modern conversational mode and graphic computer devices. They are already beyond the initial steps of this,

primarily in connection with design of various pipe networks (water and gas supply, sewerage and irrigation).

Mechanization of the computation and charting tasks (and the creation of uniform data bases) of geodetic and geotechnic work preparatory to planning is important in the interest of construction industry CAD development. Outstanding among the results in this area is the practical work of the Surveying and Soil Testing Enterprise.

In accordance with its purposes, the conference gave a broad overview of construction industry CAD, extending to practically every branch of architectural and civil engineering. Both speakers and audience included experts from planning enterprises, researchers and teachers, from Budapest institutions and regional centers--regardless of the chief authority to which they belonged. The speakers included not only leaders in their fields but also those who are still struggling with the initial problems of computer development.

The first group of speakers at the technological installation design section dealt with general principles and computation methods, chaired by Dr Pal Benedek.

Jozsef Hay and Laszlo Szoboszlai (VEGYTERV [Chemical Industry Design Bureau]) gave a talk titled "The Computer in Installation Planning" in which they outlined a uniform planning system, and reported on the machine background needed for its realization and the programming and organization tasks needed for preparation.

Miklos Ritvay (OLAJTERV [Petroleum and Gas Industry Planning Enterprise]) reported on the use of simulation in planning. He showed, in connection with concrete oil industry technologies and distribution systems, how one could achieve significant savings in the area of investment costs with applied computer methods.

Gyula Joo, from the Heavy Industry Technical University in Miskolc, outlined computer methods for danger and hazard analysis of chemical industry technologies. The method demonstrated makes it possible to do a hazard analysis of critical phases of technologies on the basis of exact methods at one's desk, calling attention in advance to those points where it is necessary to change the technologies and linkages prepared or where the proper settings can avoid the emergence of a dangerous situation.

Peter Sugar (OLAJTERV) gave a report on an energetics study of the manufacture of petroleum products, casting light on the energetics background of the production and processing of various products. He described a method which makes it possible to study these questions with computerized methods.

Jozsef Ferenzy (VEGYTERV) described a graphic element editing system. It is one of the most important characteristics of the method described that it is not necessary to give a complete description every time of elements which are repeated; one need only cite their names and the details have to be

given only once. It is another essential aspect of the method that it produces a data system indpenedent of the computer.

The second group of papers dealt with pipe design and apparatus dimensioning, one of the most essential areas of technological installation planning and one most promising from the viewpoint of computer processing.

Laszlo Molnar and Peter Kaboldy (BME), Gabor Szilvassy (ALUTERV FKI [Aluminum Industry Design Institute, Metal Industry Research Institute]) and Laszlo Jakab, Jozsef Grosz, Istvan Szakacs and Istvan Arato (VEGYTERV) described the principles and realization of essentially very similar systems. It is the goal and essence of all the systems that they embrace the entire theme from providing design data all the way to parts nomenclature, isometric drawings and budgeting. On the basis of the papers presented the actual realization of the systems is not at the same level.

It became clear, from the description of the program module prepared by Istvan Arato for isometric drawings, that even such an apparently relatively more simple task poses a great many problems of detail and that there are stumbling blocks which cause serious difficulty in the course of realization, for example, in drawing and dimensioning lines not falling in the direction of coordinated axes. The problems of placing dimensions, signs and entry numbers are all themes each of which require significant expenditure of labor, while producing with the system drawings understandable to and useable by the contractor.

The goal in each system is for the computer subsystem to embrace hydraulic calculations and flexibility analyses of the pipe lines. The talk by Ferenc Kolonits (EGI [Institute of Energy Economy]) went into the details of flexibility analysis. Going beyong the solutions known thus far he called attention to certain difficult points of this significant theme and to the possibilities for their solution.

The theme goes beyond the area dealt with by the technological installation design section and there is a similar need for similar tasks in mechanical and architectural CAD. There is need for close cooperation, knowledge of the subsystems being developed there and a study of the possible use of them also.

Two papers dealt with the theme of apparatus dimensioning (by which we mean dimensioning in accordance with Hungarian and DIN and ASA standards). Laszlo Varga, Peter Gara and Gyorgy Kollar (BME) described possible cases for computerized strength studies of pressurized vessels, primarily apparatus dimensionable on the basis of shell theory, and results achieved thus far, supported by experiments too. Katalin Dobos and Istvan Albert (VEGYTERV) described an interdependent dimensioning system, performed with a desk computer for apparatus prescribed for approval by boiler safety inspection, important from the viewpoint of practice.

Probably because of an unfavorable time slot the attendance at this section of the conference was not so large as the theme would have merited. It is to

be hoped that the audience and the circle of those interested can be expanded with the appearance in writing of some of the papers.

The third group of papers, under the chairmanship of Mihaly Sandory, dealt with process control problems.

Speakers from the BME automation and process control faculties demonstrated that there are a number of tools for computer design of control systems and for microprocessor process control (the ICONOGRAPH program package, PDP-11, LSI 11 and ABD-80, BASIC interactive program packages, etc.). The paper also included a study of the functioning of phased-semicontinuous processes.

The CAD training section reviewed the broad, organized efforts to introduce CAD into training.

Gyorgy Paris, director of the Science Organization and Informatics Institute, reported on, among other things, the goal and tasks of the CAD target program of the Ministry of Culture. Training in CAD is the subject of 31 of the themes accepted as a result of the research and development support competition announced by the ministry in 1981. There is a great possiblity for progress in winning the UNDP (UN Development Program) competition, which will make possible realization of a model training system.

Imre Szabo, deputy rector of the BME, gave a talk titled "The Status and Achievements of CAD at the Budapest Technical Univesity." Research initiated by the faculties is significant, in addition to research commissioned by the state. He called attention to the ever expanding circle of faculties, teachers and students becoming active cultivators of CAD.

The training section cast light on a number of sides of the themes from documentation systems through the CHEMISYS chemical industry design training project to the introduction of microcomputers into training. The last theme was supplemented by an effective on-the-spot demonstration.

Papers dealing with training were given at a number of other section sessions also.

Especially lively attention attended the section on finite element methods. The session was characterized by a humber for information, a readiness to debate and an extraordinarily constructive spirit.

The talk by Imre Komaromi and Andras Meinhardt (SZAMALK [Computer Technology Applications Enterprise]) discussed the use of computer graphics in the area of finite element strength and thermic analysis.

Istvan Paczelt (NME [Heavy Industry Technical University]) described a program system called TESZGA for strength calculations of axis symmetrical flexible structures. This system is well known in our homeland and its successful applications prove the effectiveness of finite element methods.

Laszlo Sarkozi and Mrs Ferenc Horvath (NME) dealt with the design of a safety system for mine galleries and demonstrated one area--among very many--for application of the finite element methods.

Debate at the section session showed that even if our homeland does not have such outstanding opportunities for application of the finite element method as in developed countries we do have understanding experts who make adequate use of our opportunities. Professional public opinion--even recognizing the problems--expects much from the approaching acquisition of ASKA.

The largest number of papers at the general section (hardware and software problems of CAD independent of profession) dealt with computer graphics.

Thematically this included papers dealing with developmental trends in computer graphics and prospects for domestic development (Gergely Krammer and Pal Verebely), questions of topographic representation of engineering tasks on a graphic machine (D. Wildner) and interactive editing of technical drawings (L. Nador and T. Under).

The other sections also included papers on the graphics theme and it appeared from the comments that the conference well served an exchange of experiences.

A few papers reported on developmental achievements with general use programs (Videton, SZTAKI and BME) for the purpose of aiding various professional applications.

Linked to graphics and included in the general section were papers discussing cartographic questions, which embraced problems of a digital relief (field) model, computer survey and cartographic methods and identification of spatial objects. (Only one paper in this section dealt with cost analysis questions of CAD, which seems few considering the importance of the theme.)

Form design also appears in the area of computer design. It can be presumed that this will be followed by further work and will create a link between form designers and draftsmen.

The conference was at a high level. The great interest, the large number of reports, the papers accompanied by attention and the debated show that--despite the difficulties--the most crucial questions of technical development have come into the center of attention.

Technical public opinion is a sensitive indicator. The coordination of CAD work has done much to help evaluate the trends. The chance reports were put together into a surprisingly uniform program. The themes selected here embrace the most important areas.

Readers of this article will find the best of the papers in the periodical professional press in the near future.

We hope that the First National Automated Technical Design Conference has begun a series which will offer aid in the solution of our economic tasks.

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COMPUTERIZATION OF AVIATION INDUSTRY DESCRIBED

Warsaw PRZEGLAD MECHANICZNY in Polish No 8, Aug 82 pp 13-17

/Article by Andrzej Nowakowski, graduate technological engineer and project leader in the Department of Technology at WSK-PZL Swidnik (Transportation-Equipment Plant-Polish Aviation Plants)/

/Text/ Olivetti Minicomputer Hardware in the Aircraft Industry

Exploitation and types of application of minicomputers for design, technological, and organizational projects.

Today's aircraft industry is characterized by a high degree of automation of manufacturing, by the use of modern production equipment, and by corresponding expansion of services for technical preparation of production. From its inception it has been the vanguard of machine industry; it was that branch, where, beside innovative designs, innovative technologies and new production installations were employed, which later found wide application in other fields of manufacturing.

During the last years there have appeared in the civilian aeronautics new constructions called wide-body frames which are capable of taking on board up to several hundred passengers and of covering distances of up to 10,000 kilometers. Characteristic attribute of this group of designs (which, at the same time, determines the direction of future development of design and of technological thinking) is the use of so-called integrated elements as well as designing and constructing of appropriate aerodynamic surfaces.[1] Manufacturing of such products requires, however, employment of special methods both in the design stage as well as in the stage of technical preparation of production (TPP) and in the production itself. Such jobs require enormous calculation capabilities; it is also necessary to have at one's disposal the right software and to use numerically controlled machine tools.

State of the Arts in Polish Aircraft Industry

In its present condition, while our aircraft industry does not play any significant role in determining direction of worldwide development, it is, however, dependent upon it. Construction of wide-body airframes in the Polish aircraft plants began, with some delay, at the start of coproduction with the

U.S.S.R. of airbus IL-86 forcing thereby the use in the technical preparation of production and in manufacturing of certain methods based on numerical techniques.

Most of the aircraft plants have their own computer with relatively large computing capabilities or have access to such a computer (these are the machines of the Uniform System of Electronic Digital Computers).

One of major problems is the lack of appropriate peripheral equipment indispensable for the process of TPP /technical preparation of production/. The most often employed RYAD computers have no punched tape reader, tape punch, or plotter. This narrows down essentially possibilities of using this hardware. Another difficulty is the often limited access to the computer (due to the large number of users and to the excessive percentage of time devoted to processing of data.) Reliability of this hardware also leaves much to be desired.

When it comes to the systems useful in aircraft manufacturing there is, really, only one that meets necessary demands. This is the NARVIK system (POUT5, APT-IV) /Automatically Programmed Tool/ codesigned by WSK-MIELEC and the Warsaw Polytechnical Institute. This is both a design and a technological system but at present only the technological part is available (the APT system OSN programming).

The above-mentioned difficulties as well as organizational problems and psychological resistance of users cause essential delays in the introduction of large-scale computers in manufacturing processes of the aircraft plants. As a consequence, even those plants which have appropriate hardware and software and qualified technical personnel use large computers for TPP processes only when there are no other ways of solving the problem.

Minicomputers do not possess the operating defects of large computers. Beside the relatively large capabilities essential for present needs of our aircraft production they possess following advantages:

- large selection of peripheral equipment,

- appropriate special-purpose software,

- ready access, since the organizational unit using this equipment is, as a rule, its only user,

- compact size occupying small area without need for air-conditioning,

- small cost of purchase and of operation,

-simplicity of operation

- possibility of writing own software by technical personnel not specializing in information science.

Many concerns have special-purpose minicomputer hardware such as: SM3 with NMG system; special-purpose Hewlett-Packard and PDP minicomputers; minicomputers MERA; and special-purpose minicomputers Olivetti. Those last mentioned are most often employed in our aircraft industry plants.

Olivetti Minicomputer Configurations

Olivetti minicomputer configurations are used for engineering calculations, among other places, at Communication Equipment Production Center at Mielec, Rzeszow, Swidnik, and Kalisz, as well as in ZAMET Metal Works in Tarnowskie Gory. Total number of all minicomputer configurations based on the central processing unit P6060 and P6066 which are employed in the country is 16. Their main advantages are: simplicity of operation and of programming, good special-purpose software, and low operating costs.

Typical minicomputer configuration for engineering computations may consist of following hardware (Fig. 1):

- central memory unit P6060 (or P6066) with user memory storage of 48 kbytes (with capability for further expansion) + 32 kbytes reserved for the operating system. The unit consists of: alphanumeric keyboard; operator's console; functional keys; alphanumeric display (32 characters); thermal printer (for 80-character line); and two floppy disk units with 256 kbytes of disk capacity,

- punched tape reader,

- tape punch,

- character/mosaic printer (of the type: PR1230, PR1350, PR1370 or other),

- plotter of varying type and size, for instance X-Y600, Benson 1202 (Fig. 2).

Central processing unit may be equipped with standard asynchronous line control unit RS232V24. Other types of peripheral units are also available, such as a hard disk unit of 9.8 megabytes capacity; a video display; and cassette tape and magnetic tape units.

The distinguishing characteristic of the minicomputer P6060 (and P6066) is the storage of the operating system[2] on direct access external memory units, for instance, on the system's floppy disk. Initialization of operations of the minicomputer requires reading in each time of the operating system's disk which must remain all the time on the disk unit during minicomputer's operation. In spite of certain shortcomings this type of arrangement has an essential advantage, namely, the possibility of changing and improving of operating systems and of parallel employment by users of various types of systems with various types of capabilities (system read-in time takes less than 20 seconds).

Organization of operating functions of the central unit as well as control of peripheral units is simple and limits operator's intervention to a necessary minimum.[3]

Set of operator's commands available in individual versions of the operating system is a successful solution of finding an optimum between simplicity of operation and preservation of maximum capabilities. Typical example here is the organization of libraries (data files) on disks (floppy or hard). The user in a simple manner can create, write, and modify files in particular libraries without worrying about their addresses and optimal distribution on disk since this is done automatically by the operating system. At the same time, the error diagnostic is built up to a considerable degree, as well as the control over carrying out of operator's commands correctly.

Another advantage is the possibility of quick correction, changing, and up-dating of text files and of programs written in BASIC language. After reading them into operating memory there is direct access to every character as well as possibility of automatic renumbering of lines, deletion of entire file segments, concatenation to other files etc.

Expert mastering of operator's functions of the operating system of RELEASE 3 level does not present any problem for technicians not prepared for working on digital computers. This is confirmed by the training of technical personnel which directly operate, or write programs for, minicomputers throughout the country. This personnel cadre is mostly composed of technicians and mechanical engineers.

Programming language used on Olivetti minicomputers is an expanded version of BASIC (a higher, problem-oriented language). BASIC is a language very easy to master which allows to write simple programs already after only few hours of instruction. However, its basic version is not always adequate for solving complicated engineering problems. For this reason it was decided to expand it to include the so-called matrix, plotter, and string options.

Matrix option allows operations on two-dimensional tables: addition, subtraction, multiplication, calculation of determinants, creation of inverse matrices etc.

Plotter option allows the use of thermal plotter's instructions as plotter instructions. This has considerable importance for standardization of plotting programs which service various types of external plotters. These plotters are equipped with a multiline function which translates BASIC language instructions into the plotter's programming language. Verification of a plotting program consists then only of linking the appropriate function to the main program.

String option allows the use of various operations on alphanumeric (text) variables. This option is particularly handy, for instance, in the phase of formation of blocks by the post-processor. Beside the basic capability of concatenation of alphanumeric expressions, searching for character strings, metric conversion, complementing etc., it is possible to use compare as well as logical operations (Boolean algebra). With such extensive operations on text variables simplification became essential by channeling communication between central unit and the peripherals exclusively through these variables. As a result, appropriate coding of control variable for output units or

decoding of signals received from input units does not create great problems. String option also allows to effectively take advantage of BASIC language in typical data processing operations, for instance, in formatting printouts.

Succeeding versions of the operating systems (RELEASE 2.0, 2.1, 3.0, 3.1, 3.2) are expansions and continuations of previous versions in the area of operator's commands and in BASIC language statements. At the same time the principle of upward compatibility of all versions is observed, that is, the availability of existing operator's commands and BASIC language statements in each subsequent version. RELEASE 4.0 version introduces essential enhancement of operator's commands while retaining at the same time upward compatibility.

The method of inputting and of testing programs written in BASIC language allows for quick correction of programming errors. Each program line intput from the keyboard is checked for format errors and only then is moved into memory. Statement errors are flagged with simultaneous indication of the error.

Use of the so-called "debug" mode proves very effective during testing of programs. It allows to stop the execution of the program in a particular step and then to execute following operations:

- carrying out calculations in the computing mode,
- read-out of values of program variables,
- assigning of specific values to variables,
- continuation of program execution from a given line number.

Manufacturer-supplied software for Olivetti minicomputers used in the aircraft industry consists of systems of automatic programming OSN [numerically controlled machine tools] (available are also other problem oriented modules such as: mathematical, architectural, engineering, PERT method, and others). These systems are divided into two groups: system GTL3 for programming of milling machines and multioperation machine tools with continuous 2.5-axis control and system GTL/T designed for programming of lathes with 2-axis control. System GTL3 consists of a geometric processor and a technological processor.[4] Basic elements of the geometric processor are: point, straight line, and circle. The geometry of the part to be machined is described on the basis of these elements. The characteristic which distinguishes this geometry is that it is oriented (geometric elements have a sense of direction). This facilitates description of contours and shortens the length of a program for machining of parts, as compared with the nonoriented geometry.[5] Also available are point sets (circle, line etc.) as well as the use of up to 20 different systems of coordinates.

Technological processor allows for simultaneous use of three different levels of technological automation. First level--manual technology--allows the part programmer to choose tools, machine-cutting parameters, and machining sequences. With the second level--semiautomatic technology--the part programmer can intervene in the choice of parameters by the system. Third level--automatic technology--allows for completely automatic selection of tools, machine-cutting parameters, and of the sequence of tool paths during machining. The user here can select given parameters and enter them into the system's memory.

In the aircraft industry primarily used is the first level of automation due to the specific features of machined elements. In all other cases, however, where the use of higher levels is justified, this accepted concept of automation of technology constitutes the optimal solution.

The geometric processor of the GTL/T system does not differ essentially from the GTL3 processor, however the technological processor is much more extensive due to the complex character of technological problems and, consequently, it requires much more programming time.

Directions of Application of Olivetti Minicomputer Configurations in the Aircraft Industry.

At WSK-Swidnik Olivetti minicomputer configurations are used mainly for OSN automatic programming. All-automatic programming has been applied on 34 milling machines and multioperation machine tools with 2.5-axis control (Fig. 3). The GLT/T system is also used. Machining of elements with very complex contours has necessitated the expansion of capabilities of the GTL3 system. Maximum number of machined surfaces has been increased from 30 to 50 and also additional capabilities have been introduced to accommodate specific characteristics of those elements. As a result, the possibility of accomplishing following functions has been realized:

- changing the plane of interpolation,

- repetitive roughing,

- production of symmetrical parts with retention of forward direction (or backward direction) of milling while using the same machining program,

- control over continuity of tool paths.

From the production profile at WSK-Swidnik a conclusion can be drawn that the GTL3 system can be used to program very complex operations where the length of the part machining program may reach up to 1000 lines and of the generated control program up to 2000 to 2500 blocks (full processing time, including simulation of machine operation on the plotter, takes then 4 to 6 hours).

The GTL3-Video version of the system is presently available in the aircraft industry. It produces graphic representation of the machining program on the monitor's screen. Such a system is now used at WSK-PZL-Kalisz. A three-dimensional version--GTL3D--is also being prepared.

Number of post-processors in libraries which are at the disposal of aircraft plants is, on the whole, sufficient. Those programs are geared to the majority of the used OSN /numerically controlled tools/ with continuous 2.5-axis control. Altogether 13 post-processors are involved. They have been programmed in individual plants, partly in cooperation with the Cutting Tools Institute in Krakow. Variety of available post-processors allows to write quickly (in a matter of weeks) a post-processor for a new type of control system.

At WSK-Swidnik--besides writing of post-processors--another direction of mechanization of programming is being developed with the use of the Olivetti hardware. The so-called translators of control programs are being used to convert a program for one type of control system into a program for another type of control system.

A specific problem in the aircraft industry presents the machining of so-called theoretical contours, that is free-flowing surfaces defined by a mathematical function. Such contours must be approximated by geometric elements determined by the type of interpolation used by machine tool's control system. This usually is a linear-circular interpolation. The GTL3 system does not offer here a full range of possibilities. It does not offer successful methods of control of the curve generated by the system if it is a curve defined by an equation. Also it does not offer blending of the curve with circles and straight lines which define the element to be machined.

At WSK-Swidnik appropriate programs have been written which allow to pass from a definition of a curve by an equation or by a set of points to a definition acceptable to the GTL3 system, that is, composed of straight lines and circles. Parameters of circles and lines which approximate the curve are calculated on the basis of coordinates of input points defining the curve. It must be added that here there is a possibility of full control of the approximation.

Programs of this type work on given base points (nodes of interpolation) or themselves select interpolation nodes on the basis of the discreet description. In the end, both groups generate description of the geometric curve in GTL33language which constitutes a fragment of the geometry of the machined element. The input data are the coordinates of points on the curve (even several hundred of them). Generally, these points can be generated by the computer system from numeric representation of geometric figures. WSK-Mielec uses such a system called Numerical Master Geometry (NMG) which runs the automatic drafting machine made by Kongsberg. Other plants of the aircraft industry also have access to it through a cooperative arrangement. For this reason a program has been developed to allow to transfer via punched tape intput points generated by the NMB system to the Olivetti minicomputer.

Next group of applications of Olivetti minicomputers linked with the numerically controlled machine tools /OSN/ is the reproduction and storing of control tapes. Majority of the employed OSN's are equipped with control systems without the capability of storing of the control program in memory. This means that the information on punched tape must be read in by control system's reader every time the program is being run. In view of the limited durability of punched tapes and of unreliability of punched tape readers it is necessary to copy tapes periodically. Appropriate software allows error-free copying of tapes in any given code from the original stored on external memory disks. Equally successful can be automatic or semiautomatic correcting of control programs, concatenating of programs, partitioning them etc.

Computer-oriented organization of storing and reproduction of tapes also forces organizational discipline and uniformity of source documentation, an essential requirement in view of the role of N/C tapes in controlling production processes.

At WSK-Swidnik a digitizing machine Inspector Maxi 600V driven by P6060 mini-computer has also been installed. This opens new possibilities of connecting machining programs with measuring programs. Digitizing machine constitutes here the final link of the production process which starts with computer-aided recording of data and ends with computer control [of production].

Reliability of Olivetti peripherals, on the whole, is good, however, the central unit P6060 manifests an especially high degree of reliability. During a three year, two-shift operation there was only one major malfunction of the control processing unit.

FOOTNOTES

1. This characteristic flows from reaching a certain ceiling in engine efficiency and in the weight of construction materials. The only rational way of increasing load capacity and range is, in this situation, to decrease the overall weight of the aircraft (by replacing of sub-assemblies of lifting structure composed of many parts by a single or a few integrated elements) and to choose appropriate contours for aircraft fuselage.

2. An operating system is a collection of computer programs which control the operations of a digital computer.

3. There exists also a possibility of automating of operator's functions by the use of appropriate procedures.

4. The GTL3 system processing is a two-phase operation. Phase one: processor generates machining sequences according to an established format in a general manner not geared to the particular type of control and to the type of machine tool. It writes results as intermediate data--so-called CL Data. Phase two: post-processor applies intermediate data to the given control system and type of machine tool and generates an N/C tape.

5. The program of machining of a given part is a symbolic geometric and technological description of the part to be machined with the aid of a series of statements whose semantics and syntax form the GTL3 language.

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END